MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2016/2017

PEM0026 – TRIGONOMETRY AND GEOMETRY

(All sections / Groups)

17 OCTOBER 2016
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of 6 pages.

2. Attempt **ALL FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided. All necessary working **MUST** be shown.

4. Only **NON-PROGRAMMABLE** calculator is allowed.

APPENDIX

TRIGONOMETRY IDENTITIES

$\sin^2\theta+\cos^2\theta=1$; $\sec^2\theta=1+\tan^2\theta$; $\csc^2\theta=1+\cot^2\theta$

$\sin 2\theta=2\sin\theta\cos\theta$

$\cos 2\theta=\cos^2\theta-\sin^2\theta=2\cos^2\theta-1=1-2\sin^2\theta$

$\tan 2\theta=\dfrac{2\tan\theta}{1-\tan^2\theta}$

$\sin(A\pm B)=\sin A\cos B\pm\cos A\sin B$

$\cos(A\pm B)=\cos A\cos B\mp\sin A\sin B$

$\tan(A\pm B)=\dfrac{\tan A\pm\tan B}{1\mp\tan A\tan B}$

$2\sin A\cos B=\sin(A+B)+\sin(A-B)$

$2\cos A\cos B=\cos(A+B)+\cos(A-B)$

$2\sin A\sin B=\cos(A-B)-\cos(A+B)$

$\sin A+\sin B=2\sin\dfrac{A+B}{2}\cos\dfrac{A-B}{2}$; $\sin A-\sin B=2\cos\dfrac{A+B}{2}\sin\dfrac{A-B}{2}$

$\cos A+\cos B=2\cos\dfrac{A+B}{2}\cos\dfrac{A-B}{2}$; $\cos A-\cos B=-2\sin\dfrac{A+B}{2}\sin\dfrac{A-B}{2}$

$\sin^2\dfrac{A}{2}=\dfrac{1-\cos A}{2}$; $\cos^2\dfrac{A}{2}=\dfrac{1+\cos A}{2}$; $\tan^2\dfrac{A}{2}=\dfrac{1-\cos A}{1+\cos A}$

$\sin\dfrac{A}{2}=\pm\sqrt{\dfrac{1-\cos A}{2}}$; $\cos\dfrac{A}{2}=\pm\sqrt{\dfrac{1+\cos A}{2}}$; $\tan\dfrac{A}{2}=\pm\sqrt{\dfrac{1-\cos A}{1+\cos A}}=\dfrac{1-\cos A}{\sin A}=\dfrac{\sin A}{1+\cos A}$

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QUESTION 1 [25 marks]

a. Given that $\sin\theta = \frac{a}{5}$, $\tan\theta = \frac{a}{a+1}$ and θ lies in the first quadrant.
Find the constant value of a. [6 marks]

b. Given that $\tan\theta = -\frac{4}{5}$ and $\cos\theta > 0$, find the exact values of $\csc\theta$ and $\cos\theta$. [3 marks]

c. Given $f(x) = 2\sin(-2x - \frac{\pi}{2}) + 1$,

i. find the amplitude, period and phase shift of the function $f(x)$. [5 marks]

ii. sketch the graph of $f(x)$ in the interval of $0 \le x \le 2\pi$. [6 marks]

d. If $\tan\theta = 3$, using trigonometry identities, find
$\sin^2\theta + \sin\left(\frac{\pi}{2} - \theta\right) \cdot \cos\theta - \cot\left(\frac{5\pi}{2} - \theta\right)$. [5 marks]

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QUESTION 2 [25 marks]

a. Write each trigonometric expression as an algebraic expression in u.

i. $\tan\left(\cos^{-1}\left(\frac{5}{u}\right)\right)$

[5 marks]

ii. $\sin\left(2\csc^{-1}\left(\frac{u}{\sqrt{u^2-4}}\right)\right)$

[5 marks]

b. Given that $a = \cos\alpha$ and $b = \sin^2 4\alpha$.
Using trigonometry identities, express b in terms of a by eliminating α.

[7 marks]

c. Find all real numbers, in terms of π, that satisfy the equation
$\cos^2 x + 2\sin x\cos x - \sin^2 x = 0$ over the interval of $0 \le x \le 2\pi$.

[8 marks]

Continued...

QUESTION 3 [25 marks]

a. Given an equation $r = 26\cos\theta$.

i. Convert the polar equation to a rectangular equation. [5 marks]

ii. Graph the rectangular equation using rectangular coordinate system. [2 marks]

b. Use De Moivre's Theorem to find $\left[\sqrt{2}\left(\cos\frac{3\pi}{10}+i\sin\frac{3\pi}{10}\right)\right]^5$.

Express the answer in rectangular form, $a+bi$. [5 marks]

c. An airplane approaches runway at 240 km per hour in the direction that makes an angle of 8.5° with the runway. Express the velocity vector **v** in terms of **i** and **j**. [3 marks]

d. Determine the angle between vectors $\mathbf{m} = -6\mathbf{i} - \mathbf{j}$ and $\mathbf{n} = 4\mathbf{i} + 9\mathbf{j}$. [6 marks]

e. Find the cross product of vectors $\mathbf{p} = -2\mathbf{i} + 3\mathbf{j} - 4\mathbf{k}$ and $\mathbf{q} = \mathbf{i} - \mathbf{j} + \mathbf{k}$. [4 marks]

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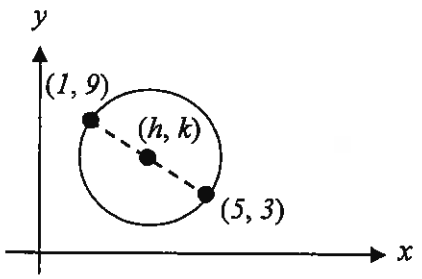
QUESTION 4 [25 marks]

a. Given that point (h, k) is the center of circle.



i. What are the values of h and k ? [2 marks]

ii. Find the radius of the circle. [2 marks]

iii. Write a standard form of equation for the circle shown above. [2 marks]

b. i. Find the equation of an ellipse that satisfies the following conditions:

Center is located at origin.
Foci are located at $(\sqrt{3},0)$ *and* $(-\sqrt{3},0)$.
Vertices are located at $(-2,0)$ *and* $(2,0)$. [6 marks]

ii. Graph the ellipse and label the center, foci, vertices and y - intercepts.

[4 marks]

c. The equation for a hyperbola is given as $\frac{y^2}{81}-\frac{x^2}{64}=1$.

i. Find the vertices. [2 marks]

ii. Find the foci. [4 marks]

iii. Find the equations of asymptotes. [3 marks]

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